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ABSTRACT

Phonetic science is becoming increasingly interdisciplinary. Phoneticians rely on, or at least collaborate with, sociologists, psychologists, biologists, poets, physicists, anthropologists, neurologists and others. A look at the history of phonetics reveals that this seemingly recent trend has deep roots. In fact, it is possible to draw parallels between the nature and direction of interdisciplinary influences on the work done by contributors to phonetics both now and in the past. Several quotations from current journals indicate that the study of phonetics has become interdisciplinary; in many instances phoneticians are contributors to other areas. One example of such research partnerships was developed in the early fifties by Pierre Delattre, phonetician-linguist, Alvin Liberman, psychologist, and Franklin Cooper, physicist. Such collaboration should not be confused, however, with the interdisciplinary nature of phonetic study, which has a long history. Some prominent figures in this history are Alexander Graham Bell, Franz Boas, Edward Sapir, Benjamin Franklin, Alexander Ellis, and Christian Kratzenstein. (AMH)

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"Phonetics and Other Disciplines: Then and Now"

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Chaired by Professor E. F. K. Koerner

(20 minutes)

1. How pleasant it would be were we able to state at this (or any) meeting of phoneticians that our investigations indicate that the Renaissance Men and Women of Academia are obviously those (or at least many of those) whose interests are deep in the phonetic sciences. The temptation to do so is perhaps not so wide of the mark if one does examine who (or what) phoneticans are and what many do and have done. There is more than slight justification for the statement that reasonable numbers of phoneticians bring, and have brought, to this discipline a wide background of interests and expertise in many, many fields of scientific and humanistic endeavor. Even a cursory study of those current journals in which studies in phonetics appear demonstrates a trend for such contemporary studies to become more and more interdisicplinary in nature. Phoneticians increasingly rely, it seems, on the work of, or collaborate with, sociologists, psychologists, biologists, poets, physicists, anthropologists, neurologists, and others. And a look at the history of phonetics reveals that this seemingly recent trend has deep roots. Earlier phoneticians seemed no less prone to incorporate into their work the ideas and findings from other areas of investigation or other disciplines. It is possible, in fact, to draw parallels between the nature and direction of interdisciplinary influences on the work done by those we identify as contributors to phonetics both in the current scene as well as in earlier scenes.

2. Consider the effect of the following passages upon a beginning student of phonetics (or a phonetician unaware of the history of his discipline). The first passage is taken from the Journal of Phonetics Volume 4 (1976) and is concerned with the description of the articulation

of English 121. It appears in an essay by David Leider. We quote you from the third paragraph of that essay.

METHODS

Bipolar hooked-wire electrodes (0.002 in diam., platinum-iridium alloy) were threaded through the cannula of a hypodermic needle and inserted into the following tongue muscles of two subjects, both speakers of standard American English:[1] genioglossus (GG), medial intrisics (MI) two-thirds down from the tongue tip, the most anterior portion of the superior longitudinal muscle located at the tongue tip (TT), and the styloglossus (SG).[2] The entire assembly was inserted directly into the muscle, after which the cannula was withdrawn, leaving the hooked ends of the wires embedded in the muscle. Prior to electrode placement, topical anesthesia (2% Xylocaine solution) was administered at the site of needle insertion by means of an air jet (Panjet-70). Correct electrode placement was verified by having the subject articulate gestures considered characteristic of contraction of the target muscle while the experimenter monitored the accompanying electrical activity on an oscilloscope and amplifier-speaker system. For a complete description of electrode insertion techniques and placement verification, see Hirose (1971) and the references cited there.

[1] A third subject was studied, but the EMG signals from this subject's tongue muscles were all well below 100 μV and therefore considered too low to permit claims or inferences.

[2] Also studied, for other purposes, were the orbicularis oris, anterior belly of the digastric, and the internal pterygoid muscles. Since the results are irrelevant to this investigation of gestural antagonism in tongue movements, they will not be reported here.

The second passage, is taken from Phonetica, Volume 33 (1976), in an essay by David J. Broad concerned with determining how two different phonetic entities can be shown to be acoustically equivalent:

> The way that this might be done can be illustrated with a case for which the necessary data exist, namely the case of determining whether the estimated targets for the vowels shown in figure 3 are equivalent to that speaker's [I] target. For these vowels, the trajectory for the ith formant frequency of the kth repetition of [I] preceded by consonant C_a and followed by consonant C_b is given by [1]:
>
> $$ {}_kF_i(ab)(t) = V_i + G_i^{(a)}(t) + H_i^{(b)}(t) + {}_kX_i(ab)(t), \qquad (1) $$
>
> where V_i is the target value of F_i, $G_i^{(a)}(t)$ is an initial consonant transition function defined for C_a and [I], $H_i^{(b)}(t)$ is a final consonant transition function defined for [I] and C_b, and ~~${}_kX_i(ab)(t)$~~ ${}_kX_i^{(ab)}(t)$ is the value assumed by a random variable $X_i(t)$ for the kth token of the speaker's productions of the type $C_a[I]C_b$. The random variable has a nearly normal distribution with a zero mean and a standard deviation in the range shown in table I for the inter-repetition variation, which is the dominant component of $X_i(t)$.

The third selection from a essay by William Labov comes from a study on the stratification of a) the initial consonant in thing, b) the use of postvocalic /r/ in words like beer, and beard, and c) the merger of /i/ and /e/:

3.a. "In ... (this) city, this phonological trait has been generalized throughout the _____ community, so that younger speakers, whether or not they show other ... characteristics in their speech, regularly show this merger. Thus this linguistic characteristic acts as an absolute differentiator of the _____group, reflecting the social processes which identify the group as a whole."

and

3.b. "Many of the fundamental concepts of sociology are exemplified in the results of these studies of linguistic variation. The speech community is not defined by any marked agreement in the use of language elements, so much as by participation in a set of shared norms; these norms may be observed in overt types of evaluative behavior and by the uniformity of abstract patterns of variation which are invariant in respect to particular levels of usage. Similarly, through observations of linguistic behavior it is possible to make detailed studies of the structure of class stratification in a given community."*

Now let's return to our student of phonetics who might have concluded that what he has been referred to were the efforts of physicists, physiologists, mathematicians, statisticians, psychosociologists,

*from "The Reflection of Social Processes in Linguistic Structures," by William Labov, in Readings in The Sociology of Language, edited by J. Fishman, Mouton (1968), pp. 248 and 250-251, noted as item 3 on the Handdut.

somehow mixed into phonetic study. And if he is encouraged to read further, he may well discover healthy doses of neurology, biology, optics, mechanics, poetics, and psychology. Were he to conclude that the study of phonetics has become highly interdisciplinary in or participated in by students from many other disicplines, he would be correct, in good part. For practitioners and students of phonetics have come to rely on contributions from other disciplines. In some instances phoneticians are themselves much more than that, i.e. they are contributors to, if not experts in, other areas. In still other cases, phoneticians find themselves collaborating in their research with others whose expertise in different disciplines is essential to the development of their own phonetic research.

Among the numerous instances of such research partnerships we may mention one which developed at Haskins Laboratories in the early fifties. Pierre Delattre was the phonetician and linguist of that research team; Alvin M. Liberman was the psychologist; and Franklin S. Cooper, then President of the Laboratories, was the physicist. One is tempted to include the pattern playback, that ancestor of modern speech synthesizers, as a fourth member of the team. It was the playback, in any event, which drew the phoneticians into the research at the Laboratory. Cooper, the physicist, had designed and built the synthesizer as a prototype for the output of a speech-reading machine for the blind. Liberman, the psychologist, was working on the perceptual problems and questions raised by the manipulations of the synthetic speech signal. When Delattre, on a visit to the Laboratory, saw and heard the playback in operation, he realized its potential for phonetic research. And so he stayed on and a research team came into being. We are, of course, aware of the impact

that this team's research had, and still has, in the fields of phonetics, psychology and acoustics. However, we must note that although Cooper may have continued to handle most of the problems relating to signal generation and transmission and engineering; and Liberman may have isolated the perceptual strategies needed for speech processing; and although Delattre contributed most of the thinking which related the acoustic signal to speech production and phonetic systems -- yet after several years of work together it often became impossible to isolate an individual's contributions to a piece of research, just as it became impossible to label any piece of the team's research as belonging to one discipline or to another. The individuals and their talents in this case were, to say the least, well-suited to each other and to the research problems they undertook. And just as the abilities and interests of each broadened and merged with those of the others, so, to some extent, did the boundaries of their disicplines. Individually and collectively, the writings of these researchers have appeared in Le Maître Phonetique, PMLA, JASA, The 3rd and 4th Annual Round Table Meeting's on Linguistics and Language Teaching, American Journal of Psychology, Word, Psychology Monographs, Journal of Experimental Psychology, Proceedings of the 8th International Congress of Linguists, Language and Speech, Phonetica, Proceedings of the Institute of Electrical and Electronic Engineers and Studia Linguistica. It is no wonder that our hypothetical student might conclude that the study of phonetics has become highly interdisciplinary. We need hardly make the obvious point that interdisiciplinary collaborations of the sort we have been discussing are not now unusual. They occur not only in acoustically and physiologically-oriented laboratories from Tokyo to Stockholm, and beyond, but in universities and research centers

around the world. Further, along with the increase in collaborative efforts we can note an increase in the number of disciplines brought to bear on the study of phonetics.

Now the point we make today is that one should not confuse collaborative research efforts with the interdisicplinary nature of phonetic study. The former is almost certainly on the increase, and has been for a number of decades. Not that formal collaboration is unknown historically - but it was certainly uncommon. The latter, however, has been with us for a long time.

4. A look at the history of this discipline reveals many figures, both major and minor, whose approaches to the study of phonetics were influenced and tempered by their (and others') expertise in other areas of study. There are thus, in a study of our own roots, clear demonstrations of a long tradition of interdisciplinary study in phonetic research. We cite herein a few: * *

5.1. Perhaps among the more obvious of those with other, interdisciplinary interests would be the 19th Century inventor of the telephone, Alexander Graham Bell, whom we know also as the author of The Mechanism of Speech (1906) and "On the Nature and Uses of Visible Speech" (1872). Bell was a professor of vocal physiology, the founder of a society to promote the teaching of speech to the deaf - a physicist, physiologist, musician, speech scientist, inventor. We have almost as much right to claim him as a contributor to the phonetic sciences as do those who believe his contribution to the communication of speech through his invention puts him among the great inventors of modern times. We do not belittle their claim by suggesting ours!

* * All of these instances are developed further in the recently issued Biographical Dictionary of the Phonetic Sciences, ed. by A. Bronstein, L. Raphael, Cj Stevens, Lehman, 1977.

5.2. Two of this country's leading anthropologists, Franz Boas and Edward Sapir, also come to mind in this context. Although it is true, that neither would be identified primarily as a phonetician, one would be wrong indeed not to recognize that each did make a significant contribution to phonetics. Boas' study of the Amerindian languages led to his well known essay on "Alternating Sounds" published in 1889, in which he suggested that the perception of the phonetic shape of identical lexical items by different analysts could lead to different analyses because of the limitations of the investigators' phonological systems." Boas can be aptly described as a student of the natural sciences (his doctoral degree at Kiel was in the natural sciences); a major scholar of Amerindian languages; a linguist, phonetician, anthropologist. He is credited with having been a prime mover in forging the tools of the phonetic and structural description of many Amerindian languages. Thus Boas is claimed by more than one discipline; and if he is perhaps primarily not a phonetician, no student of his work can fairly deny him the title.

5.3. Nor can less be said of his student Sapir, whom Boas called, in the obituary he wrote for Sapir in IJAL (1939), "one of the most brilliant scholars in linguistics and anthropology." An investigation of his famous monograph on Southern Paiute shows him as a brilliant student of phonetics. Sapir is credited by some as one of the pioneers in the United States in the development of phonemic analysis. Sapir's ~~disciples~~ disciplines of areas of expertise include Germanic languages, anthropology, Amerindian languages, mythology, and linguistics --- to each of which he made major contributions. We too claim him as a phonetician, and recognize his contribution to the discipline as a major one.

5.4. No one would think of Benjamin Franklin, at first glance as "one of us" and perhaps he isn't. A founding father of this country, he was a noted world figure of the 18th century - diplomat, author, printer, inventor. Franklin's "Scheme for a new alphabet and Reformed Words of Spelling" (which he wrote in 1768) strongly influenced Noah Webster and others who followed. That "Scheme" was a remarkably accurate phonetic system of spelling. It alone should assure Franklin's place as a contributor to this discipline and no one may really deny us that privilege. If he belongs ~~in one~~ more obviously elsewhere, as he does, he belongs and is in our history and we are pleased that we can so claim him.

5.5. If one moves to the natural sciences, a number of contributors to our discipline come to mind. One of the more eminent figures is Alexander Ellis, who made significant contributions to mathematical theory and analysis in the mid-19th century. Nor can we belittle Ellis' reputation in theoretical/physical music, such stemming directly from his interest in the physical production of vowels. This major contribution on to speech and phonetics brought his influence to bear on a number of 19th century figures - school book authors like Richard Soule, lexicographers like Dan Smalley, phoneticians like Henry Sweet. Ellis' monumental work On Early English Pronunciation (in 5 parts, 1869-1889) raised him to major stature in the field of the history of the English language, perhaps eclipsing the contribution he had already made to mathematics, earlier in his life. Ellis is a noted historical figure in more than one discipline, and one of those was ours!

5.6. Another eminent contributor to the phonetic sciences was surely Christian Kratzenstein, the 18th century experimental physicist and noted

specialist in electromagnetics, metallurgy, geology, navigation, and medicine. Kratzenstein's interests led him into the area we know today as experimental/ acoustic phonetics. He is certainly a pioneer in the area of speech synthesis and sound simulation. Our current practitioners, whether they know the history of our discipline or not, are much in his debt.

5.7. Our list of phoneticians, who were also noted contributors to other disciplines or of scholars in other areas who made important contributions to the study and application of the phonetic sciences, can be extended at length. We add only a few here: Agostino Gemelli, medical doctor and psychiatrist, founder of the first Psychiatric Hospital in Italy during World War I, acoustician whose contributions to acoustic/experimental phonetics between the 1930's and 1950's are listed in many bibliographies; George Bernard Shaw, major British playwright, music and theatre critic, whose concern with spelling reform led not only to the provision in his will for a reformed English alphabet, but to the development of the I(nitial) T(eaching) A(lphabet) in British schools and elsewhere and whose Pygmalion brought "phoneticians" like "Henry Higgins" to the attention of the world; Sir Robert Bridges, 16th poet laureate of England, who, with Sir Walter Raleigh, Henry Bradley, and Logan Pearsall Smith, founded the Society of Pure English in 1913 and who acted as the head of the BBC Advisory Committee on Spoken English in the 1920's; George Lyman Kittredge, called "the most widely learned literary scholar [of his time] in America" whose interests ranged from the literatures and languages of the classical and western European languages to lexicography, Virgil, Chaucer, Shakespeare, folklore, witchcraft, and balladry - and who also wrote on the pronunciation of English and some of its dialects; Sir William Jones, 18th century comparative legal scholar, judge, noted colonial administrator from Britain to Asia, who was one of the first to methodically use native informants for a systematic

investigation of unknown languages and whose tranliterating system of Arabic, Sanskrit, and Persian lexical items was a miniature early International Phonetic Alphabet.

Add to these people like Charles Hockett whose contributions to linguistics and phonology are known to all of us here but whose vita also contains references to over 50 musical compositions from sonatas for oboe and piano, to songs for tenors and baritones, to a concertino for cello and woodwind, to organ fugues; or Kenneth Pike whose prowress as a practical and theoretical phonetician is legendary -- and who is no less a scholar of the Old and New Testaments, a published poet, the head of a Bible Society, and surely one of the truly talented actors/performers on any academic stage.

You add others -- they exist all through our profession from Dionysius of Thrace and Aristotle the Ionian to our colleagues Lou Gerstman and Katherine Harris, experimental psychologists from our own City University of New York.

Isn't it nice to be able to say that many of your colleagues were and are Renaissance Men and Women of Academia? We are indeed proud to do so.

END